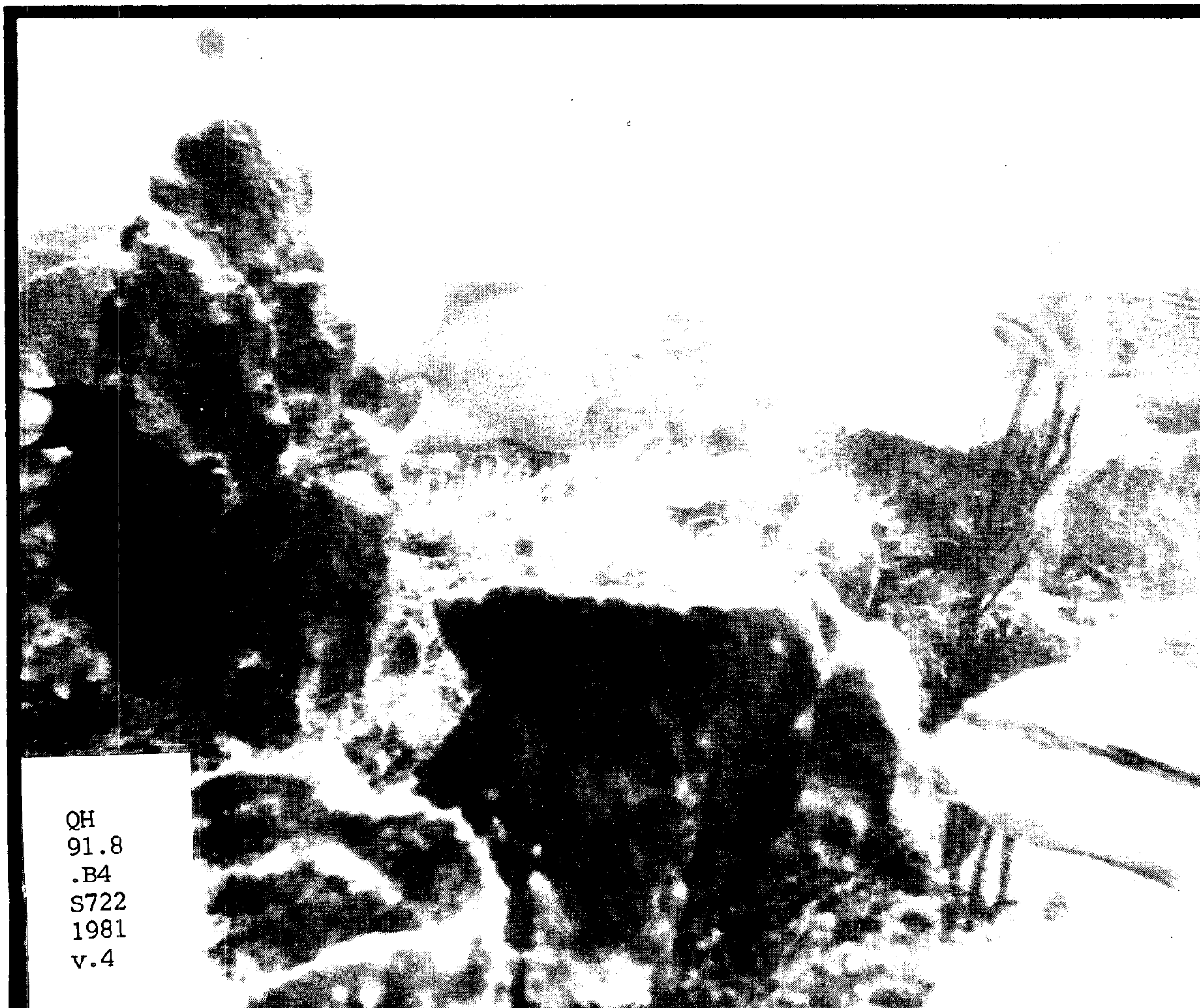
SOUTH ATLANTIC OCS AREA LIVING MARINE RESOURCES STUDY

EXECUTIVE SUMMARY



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FINAL REPORT

SOUTH ATLANTIC OCS AREA
LIVING MARINE RESOURCES STUDY

EXECUTIVE SUMMARY

Prepared for
Bureau of Land Management
Washington, D. C.
under Contract AA551-CT9-27

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October, 1981

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BACKGROUND AND OBJECTIVES OF THE STUDY

The continental shelf of the South Atlantic Bight has numerous areas of live bottom which are defined as areas containing "biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography, or whose lithotope favors the accumulation of turtles, fishes, and other fauna" (U. S. Department of Interior 1981). Although live bottom areas are known to be important to commercial and recreational fisheries of the South Atlantic region, the ecology of bottom dwelling invertebrates and valuable finfish species utilizing live bottom reefs is not well understood. Furthermore, information is lacking on the sensitivity of live bottom systems to offshore oil and gas activities.

To provide more information on these areas for proper management decisions, the Bureau of Land Management initiated the "South Atlantic OCS Area Living Marine Resources Study" in November, 1979. This study originally centered on an examination of nine representative live bottom areas off the coasts of South Carolina, Georgia and northern Florida. Prime contractor for the study was the South Carolina Marine Resources Research Institute, a branch of the Division of Marine Resources, South Carolina Wildlife and Marine Resources Department. The Coastal Resources Division of the Georgia Department of Natural Resources also contributed to the study effort as a subcontractor. In July, 1980, an additional subcontractor, Duke University Marine Laboratory, was recruited to assess three live bottom areas off North Carolina.

Primary study objectives were to characterize the invertebrate and nektonic communities associated with each live bottom area and evaluate factors which might influence community structure such as depth, latitude, bottom relief, season (except at North Carolina sites), and petroleum related activities. Characterization of the physical habitat of all study areas was intended as a more limited effort.

STUDY AREAS

The nine live bottom areas initially selected for study were located between 30°N and 33°N latitude (Figure 1). Three sites were located in each of three depth zones: inner shelf waters (19 - 27 m), middle shelf waters (28 - 55 m), and outer shelf waters (55 - 100 m). All study areas were sampled twice, once during winter and again during summer. Each of the three sites off North Carolina was also located in one of the three depth zones (Figure 1), but these sites were only sampled during summer.

SAMPLING METHODOLOGY

A variety of sampling and censusing techniques were utilized in this

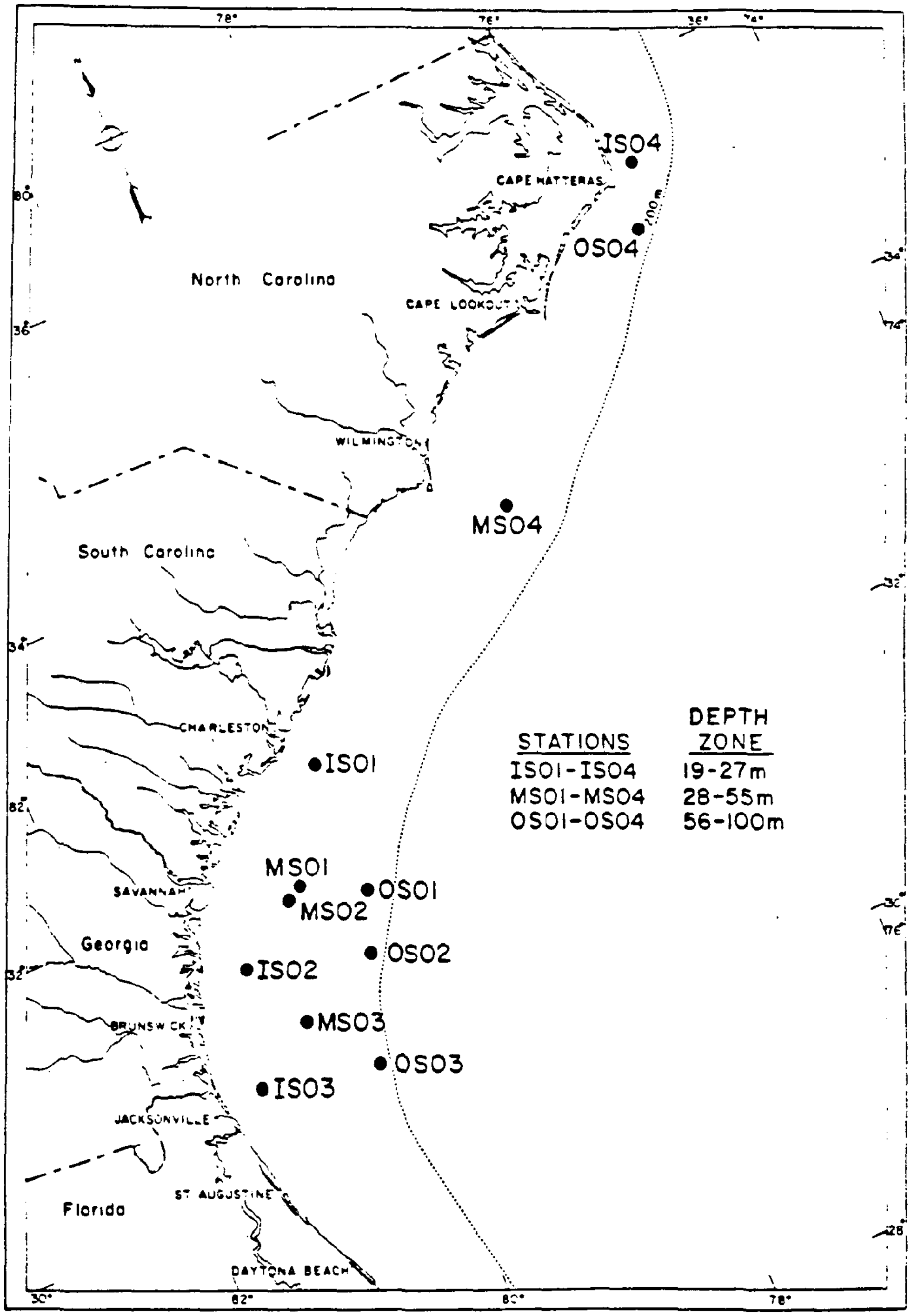

Figure 1. Location and depth zones of the twelve live bottom sites sampled during 1980.

study. Physical characteristics of the live bottom sites were assessed by mapping the areas remotely through underwater television transects, fathometer transects, and still camera photography, as well as by diver observations. These efforts provided information on the areal extent of each site, the proportion of bottom types within each site, and the degree of rock relief. Although these techniques also provided information on the biota present, additional sampling was conducted to assess community structure quantitatively and qualitatively. Fishes were sampled by day and night trawls, a juvenile fish sled, hook and line, baited traps, and by diver spearfishing and photographic surveys. Large benthic macrofauna and flora were sampled with trawls and dredges. Smaller macrofauna and flora were sampled with either an airlift suction sampler operated by divers (inner and middle shelf sites) or a Smith-McIntyre grab (outer shelf sites). Bathymetric profiles of salinity, temperature, and dissolved oxygen were obtained with Niskin bottles, and water clarity profiles were obtained using a transmissometer.

GENERAL RESULTS AND CONCLUSIONS

Hydrographic parameters measured at all study areas were typical of the South Atlantic Bight. Generally, salinity was uniformly high at all stations and depths. The few low values noted were probably the result of river runoff. Temperatures varied predictably, with inner shelf waters having a greater range than waters farther offshore. Dissolved oxygen concentrations were generally high at all stations and depths. No consistent pattern was noted in light transmission.

Diver observations, still photographs, fathometer tracings, and videotape analysis indicated that bottom topography was often patchy and irregular at the study sites, with the degree of relief and amount of emergent rock varying from station to station. Study areas were classified as low relief, moderate relief, or high relief hardgrounds, depending on the rock relief detected.

At sites south of Cape Fear, North Carolina, videotape analysis suggested that two of the shelf edge stations have areas of higher relief than inner and middle shelf stations. Other than an apparent increase in the amount of emergent rock at offshore stations, no clear patterns in distribution of live bottom were noticed. Rock outcroppings at most of these sites were covered by a layer of sand. Rock samples from inner and middle shelf stations were similar in composition, consisting of sandy biomicrite. The only rock specimen from the shelf edge was a quartz sandstone. All rocks collected were heavily encrusted with fauna which contributed to their rugosity and degree of bioerosion.

Data obtained from study areas north of Cape Fear indicated that the inner and middle shelf sites differed in geographic extent of hardground and percent sediment cover. The inner shelf site was an area of extremely high relief characterized by isolated boulders and large broken ledges of no distinct orientation; fine silt covered most of the rock surface and was also suspended in the water column. The middle shelf site, an extensive live bottom area of complex topography, had only moderate relief and little accumulation of sediment on the rock outcrop. Fathometer tracings and television reconnaissance at the outer shelf site indicated an extensive reef structure with gradual, rather than abrupt changes in depth, extensive live bottom areas, a high occurrence of ledges, and little sediment accumulation on the rock outcropping.

Epibenthic organisms associated with the live bottom areas were evaluated with respect to species composition, biomass, abundance, diversity, spatial distribution, and seasonality (winter and summer at sites south of Cape Fear). Through quantitative and qualitative sampling, 1175 taxa of invertebrates were collected from live bottom sites off South Carolina, Georgia and northern Florida; 413 taxa were collected at North Carolina sites. Algae were infrequently collected at all sites except for the middle shelf station off North Carolina where algae were extremely abundant.

Species composition of epifaunal invertebrates changed noticeably with regard to depth. Inner and outer shelf stations south of Cape Fear were least similar in species composition, while middle shelf areas were transitional and contained taxa characteristic of both inner and outer sites. Inner and middle shelf stations north of Cape Fear were more similar to each other than either was to the outer shelf station. However, dredge samples at the outer shelf station contained so few organisms that no conclusions could be drawn from them.

South of Cape Fear, octocorals and large sponges contributed heavily to the physical complexity of the habitat at inner shelf sites. Bryozoa were also frequently collected at these sites. The incidence of some octocorals and sponges declined at middle shelf stations, and few macrofaunal invertebrates were very faithful or constant in collections from this area. At outer shelf sites, large sponges and corals were uncommon; but other cnidarians and bryozoans were encountered frequently. The most abundant smaller macrofauna at all sites were polychaetes and amphipods, and infaunal organisms represented an important component of the live bottom communities. Seasonal changes in species composition were noted and may be influenced by seasonally variable conditions in the South Atlantic Bight. No latitudinal gradients in species assemblages were noted for any of the inner, middle, or outer shelf zones south of Cape Fear; however, the invertebrate fauna of these live bottom areas had a definite Carolinian and Tropical (Caribbean) component.

The major large macrofaunal taxa at the inner shelf station off North Carolina were sponges, decapods, and mollusks. At the middle shelf station, algae and mollusks were the two major taxa. Dredge samples from the outer shelf station contained few organisms; however, based on the analysis of videotapes, octocorals and echinoderms were the major large taxa. As with stations farther south, the most abundant smaller macrofauna were polychaetes and amphipods. The major difference between North Carolina stations and those south of Cape Fear was the great abundance of algae at the middle shelf station off North Carolina.

Both diversity and biomass of invertebrates from live bottom areas exceeded values reported in the literature for sand bottom biotopes. High diversity was attributed primarily to habitat complexity. Diversity values did not exhibit any pattern with respect to depth or latitude.

Potential impacts of drilling operations on live bottom invertebrate communities include smothering and burial of the fauna by drilling muds and cuttings and, hence, alteration of community structure. Placement of oil rigs or discharge points at least 1000 m from live bottom areas should lessen detrimental effects from drilling muds and cuttings. Enhancement effects from drilling and production rigs include the addition of hard substrate which would serve as artificial reefs for many epifaunal invertebrates and fishes.

Demersal fish communities associated with the live bottom areas south of Cape Fear were composed of detectably different assemblages at inner, middle, and outer shelf sites. There were seasonal changes in species composition and abundance in each of these three depth zones, but the middle shelf community appears to be the most stable. At all sites, species composition differed between day and night trawl catches. Total biomass and abundance of demersal fishes were highest at middle shelf stations and these areas support high concentrations of economically important species. Diversity of demersal fishes was highest and least seasonally variable on the outer shelf. Diversity was more variable with season at inner and middle shelf depths, being higher in winter on the inner shelf and lower in winter on the middle shelf. Diversity was also higher in night versus day trawl catches. Underwater television and baited fishing gears confirmed distributional patterns of priority fish noted in trawl catches and provided qualitative information on fishes at untrawlable stations. The importance of live bottom areas as spawning and nursery areas for priority species could not be determined with epibenthic sled collections.

Live bottom trawling was done only at the middle shelf station off North Carolina. At the inner shelf station, trawling was done on adjacent sand bottom. High rock relief prevented trawling over live bottom at this site, as well as at the outer shelf station. Many of the fish species caught off North Carolina were the same as those caught off South Carolina, Georgia, and northern Florida. At the middle shelf station off North Carolina, the night trawl catches were more diverse than the day trawl catches; night trawls also caught a different assemblage of species than day trawls. Since live bottom trawling was restricted to one station during one season, differences in fish communities due to depth, season, or latitude are not considered in this report.

Stomach contents analysis of priority fish species associated with the live bottom habitats south of Cape Fear documented a variety of feeding patterns. Vermilion snapper (*Rhomboplites aurorubens*) fed mainly in the water column, whereas black sea bass (*Centropristis striata*) and red porgy (*Pagrus pagrus*) fed heavily on live bottom epifauna. Red snapper (*Lutjanus campechanus*) and gag (*Mycteroperca microlepis*) are top carnivores and fed heavily on other fishes. Other dominant fishes studied included whitebone porgy (*Calamus leucosteus*) and southern porgy (*Stenotomus aculeatus*) which fed on both infauna and live bottom epifauna. Because of the many alternative food sources and the diversity of the predator and prey communities, overlap in diet among predators was low.

At sites north of Cape Fear, food habits of one priority fish species (*Centropristis striata*) and three dominant non-priority fish species (*Haemulon plumieri*, *Haemulon aurolineatum*, and *Stenotomus aculeatus*) were analyzed by comparing indices of relative importance. In contrast to results from the stations farther south, Decapoda ranked as the most important major taxon found in the stomachs of all fish analyzed. Of the four predator species analyzed, only *C. striata* appeared to have a specific preferred food item (Decapoda). Additional sampling and greater sample size are required before firm conclusions can be drawn about food habits of demersal fish associated with the study sites off North Carolina.

Oil exploration activities that might occur on or near live bottom areas could have a negative impact on fish communities associated with these habitats through reduced water quality, destruction of habitat, and smothering or alteration of prey communities as previously noted. Negative impacts would be most detrimental on middle shelf live bottoms because these areas support more stable fish communities and high concentrations of valuable demersal fishes. Alternatively, if these detrimental effects were minimized, then drilling and production platforms would probably enhance finfish populations by providing additional hard substrate for prey items; shelter for smaller demersal fishes; and a source of attraction for schooling pelagic fishes which, in turn, would support top carnivores.

METHODOLOGY EVALUATION AND RECOMMENDATIONS FOR FUTURE STUDIES

The wide variety of sampling and censusing gears used in this study provided a good characterization of the live bottom areas examined. Of the gears used for remote censusing, underwater television was extremely useful in assessing bottom type, defining boundaries of the live bottom areas, and documenting the occurrence of large invertebrate macrofauna. Information obtained with the television was primarily qualitative, and poor visibility occasionally reduced the effectiveness of this gear, especially in assessing fish assemblages. Although still camera transects provided more quantitative data, they were not as useful as the television transects because of poor visibility and the low number of quadrats analyzed.

The trawl was the most effective gear for assessing fish assemblages and provided some limited information on large invertebrates. However, high relief prevented deployment of the trawl at two of the outer shelf stations south of Cape Fear, and the outer and inner shelf stations off North Carolina. When trawls were not deployed, snapper reel fishing and baited traps were the most efficient gears used. Baited fishing gears used in this study provided information on fish distribution and collected additional specimens of priority species for stomach content analysis. The fish sled proved more effective at capturing larval than juvenile specimens, but this gear generally did not provide sufficient information to determine whether the priority species examined in this study utilize live bottom habitats for larval recruitment.

The benthic rock dredge and the Cerame-Vivas dredge were effective as qualitative samplers of sessile and encrusting macrofauna such as cnidarians, ascidians, bryozoans, sponges, and octocorals. The suction and grab samplers provided more quantitative collections and were used to assess smaller epifauna and infauna, such as amphipods and polychaetes, which washed out of other gears. The Smith-McIntyre grab, which was substituted for the suction sampler at outer shelf stations, was not as effective as the suction sampler, especially on hard bottom without a sand veneer. However, the grab samples did provide an indication of the smaller macrofauna present at deeper stations which could not be sampled by divers. Assessment of the invertebrate community through dredge, suction, and grab sampling would have been improved if more replicate samples had been collected, but substantially more time would be needed to analyze these extra samples.

Finally, diver observations and swimming transects assisted in verifying remote censusing data and provided useful information on the distribution of fishes, particularly those which avoided removal sampling gears.

Several of our recommendations for future research have already been incorporated in a second year study. These include sampling during all four seasons, relocating some stations to areas between 33°N and 34°N latitude, and modifying sampling efforts at all stations by reducing or eliminating gears which were not effective. Other recommended research, which would be especially valuable with respect to impact assessment, includes recolonization and growth rate studies, increased food habits analysis of priority and dominant non-priority fish species, and monitoring studies if oil rigs are placed near live bottom areas in the South Atlantic. In addition, similar studies should be extended to hard bottoms at depth zones beyond the 100 m depth contour in areas which are potential drilling sites.

REPORT ORGANIZATION

Due to differences in the scope of work at North Carolina sites, this report has been divided into three volumes in addition to this Executive Summary. Information presented in Volume I is restricted to efforts and results associated with the original study areas south of Cape Fear, N. C. Volume II provides information related to the study areas north of Cape Fear. Volume III contains appendices related to Volumes I and II. Further details on the information available in each volume is provided in the preceding Table of Contents.

REFERENCE CITED

U. S. Dept. of the Interior, Bureau of Land Management. Final environmental impact statement; OCS Sale 56. Proposed 1981 OCS oil and gas lease sale 56. Washington, D. C.; 1981.